**Remarks/Arguments:**

Claims 1-2, 8-10, and 22-23 are pending in this application, as this Amendment cancels claims 3-7 and 11-21 without prejudice in light of an earlier restriction requirement/election, and adds claims 22-23. In the Office Action dated July 22, 2005, the Examiner has objected to the length and certain language of the originally-filed abstract and to the written description at page 11, line 19. The above replacement abstract and text addition are seen to address and obviate those objections. The Examiner has further objected to claim 3 for antecedent basis, and has rejected each of claims 1-2 and 8-10 under 35 102(e) as anticipated by Mieher (US 2003/0048458). As claim 3 is canceled, the objection to it is seen as moot.

Claims 1 and 8 are amended to delete subject matter, which is now recited in new claims 22-23. Also, the term "a source" is deleted from claim 1 as the beams may originate from multiple sources, "tolerable" is deleted from claim 8 as non-limiting and superfluous, and the integrated range of claims 1 and 8 is amended to be an integrated range of at least one of dose variations and focal variations. Each of these are seen as broadening amendments.

The claims are not seen as anticipated by Mieher for reasons detailed below. Mieher is seen to be directed to calibrating a photolithographic system, or at least a process parameter thereof (abstract, calibration and test data in Fig. 1, focus and exposure tests and increments between tests at para. [0005], desire for quick feedback in monitoring production wafers to eliminate production stops at para. [0007]). In contradistinction, the application is more attuned to the wafer production that Mieher's disclosure seeks to keep calibrated. See the application at page 1 lines 6-9 (Technical Field) and page 10 lines 7-10 ("What is needed is a method for illuminating the mask ...") and 15-17 ("Disclosed herein are techniques to produce a source pattern for illumination of a photolithographic mask ..."). While Mieher uses some language similar to that of the pending claims, a closer reading in light of the above different purposes will illustrate that Mieher does not anticipate any of the pending claims. The order of arguments below follows the order of the contested elements as recited in claim 1.

First Distinction: light from different directions/plurality of incident beams for defining shapes.

Specifically, claim 1 recites: "**illuminating a lithographic mask with light from different directions such that intensities of a plurality of incident beams of light provide ...a window...for defining shapes,**". To this the Office Action cites to Mieher at para. [0002] lines 8-10 and para. [0044] at lines 8-9. (The Office Action cites to other paragraphs for the "window" element) Para. [0002] recites: "For example, the lithography system may include a light or radiation source that projects a circuit image through a reticle and onto a silicon wafer coated with a photoresist,". Mieher does not disclose light from different directions or a plurality of incident beams. The cited portion of para. [0044] recites: "The incident light may be directed at the pattern normally or at some angle to the normal." The whole of para. [0044] gives an overview of scatterometry, described as a measurement technique that directs incident light toward a grating structure, and measures scattered, reflected, and/or diffracted light to reveal information about the shape of the grating structure. This is a metrology technique consonant with Mieher's calibration purpose noted above, and no disclosure is seen wherein scatterometry can be used for defining shapes; it is disclosed in the context of measuring shapes already defined in a grating structure. The scatterometry of para. [0044] is used in Mieher to measure shapes defined in the wafer by the lithography system of para. [0002], and the resulting shape information is used to calibrate the lithography system. Claim 1 as quoted above provides that the different directions of the plurality of incident beams are for defining shapes. Mieher does not disclose, at paras. [0002], [0044] or elsewhere, light from different directions for defining shapes. Claim 8 recites similarly as "means for illuminating ..." and distinguishes as above.

Second Distinction: a largest possible process window in terms of an allowed range.

Claim 1 recites: "**...intensities of a plurality of incident beams of light provide a largest possible process window defined in terms of an allowed range for defining shapes,**". To this the Office Action cites to Mieher para. [0034]. Mieher is not seen to disclose a process window defined in terms of an allowed range for defining shapes, but rather a set of process parameters that are dependent on shape parameters.

Paras. [0032]-[0034] of Mieher discloses that a correlation is found between shape and process parameters to yield a dependency. Claim 1 recites in the above passage a largest possible

process window defined in terms of an allowed range for defining shapes. Mieher is not seen to use a largest possible process window; the only disclosed process window is at para. [0004], and it is determined by plotting multiple resist profile parameters. No disclosure is seen as to bounding this process window as the largest possible defined in terms of an allowed shape, whether by incident beam intensity or otherwise. To the contrary, para. [0004] discloses a 'best' or 'optimal' resist profile based on exposing a wafer with multiple combinations of focus and exposure.

Respecting the disclosure that the Office Action deemed relevant, paras. [0031] to [0039] of Mieher are seen to detail the "correlating values" element of the overview para. [0008] and claims 1 and 6-7. Whether the process parameters are dependent on the shape parameters as in para. [0034] or vice versa as in para. [0035], or whether the calibration data from that correlation derives from simulated or measured data as in para. [0036], Mieher is merely describing the interrelation between parameters and shapes, and that knowing that relation enables solving for one when knowing the other and the correlation. Said another way, Mieher discloses that if one studies or simulates the effect of varying a lithographic process parameter (e.g., a lens focus), one may find a repeatable relationship between that process parameter and some aspect of the shape (e.g., line width) of the lithographic features that are printed using that process parameter. In contrast, the claimed "maximum possible process window in terms of an allowed range" describes a tolerance level, an outer limit for defining shapes. This is quite different than Mieher's finding a correlation between parameters and shapes. Claim 8 recites similarly as a system claim.

Third Distinction: imposing through constraints a first and second set of intensity parameters.

Claim 1 recites: **"imposing, through application of at least one set of constraints, a first set of intensity parameters for representing maximum possible intensities that can be permitted for overexposed tolerance positions and a second set of intensity parameters for representing minimum possible intensities that can be permitted for underexposed tolerance positions;"**. The Office Action cites to para. [0008] of Mieher for these elements. As summarized above, para. [0008] of Mieher recites the broad Mieher concept: correlating values of a first set of shape parameters with values of a first set of process parameters to

produce dependencies, determining values of a second set of shape parameters associated with a structure, and then comparing the second set of shape parameters with the determined correlation to determine values of a second set of process parameters. This third distinction is related to the second distinction above.

First, Mieher is not seen to impose any set of constraints as in claim 1. Two exemplary constraints are described at page 18, lines 16-22; one constrains the (first set of) intensity parameters to be no smaller than any source-determined intensity for certain sample points, another constrains the (second set of) intensity parameters to be no larger than any source-determined intensity for other sample points. Thus the constraints are separate from the intensity parameters and serve to limit how the parameters may be set. Claim 1 recites this as "imposing, through application of at least one set of constraints, a first set of intensity parameters...". In contradistinction, Mieher discloses at para. [0008] merely the correlation between shape and process parameters. The Office Action appears to reject claim 1 by construing Mieher such that its process parameters define an allowed range for defining shapes, then somehow using those same shapes, which necessarily are directly tied to the process parameters by the correlation of para. [0008], as a constraint on the process parameters. Since Mieher clearly relies on an inherent relation between shape and process parameters as detailed above, changing one always and everywhere changes the other. If the process parameters are set to provide a largest possible integrated process window in terms of an allowable range for defining shapes (claim 1), then those same shapes defined by the process parameters cannot be later changed to constrain the process parameters that defined them (also claim 1) without also causing those process parameters to no longer provide the largest possible integrated process window. By the citations in the Office Action, those two elements of claim 1 cannot both be satisfied.

Claim 1 recites intensity parameters to provide a largest possible integrated process window defined in terms of an allowed range for defining shapes, and further limits those intensity parameters with constraints. Neither the window nor the allowed range is changed by the constraint in claim 1: the constraints serve to set the intensity parameters within bounds narrower than the allowed range. In short, there is not an element by element match because

reading one element of Mieher against two distinct elements of the pending claim conflates those two distinct claim elements into one, effectively 'reading out' one of them. MPEP 2131.01 (The elements must be arranged as required by the claim, but this is not an *ipsissimis verbis* test, i.e., identity of terminology is not required. *In re Bond*, 15 USPQ2d 1566 (Fed. Cir. 1990)).

Mieher is further not seen to disclose anywhere that a parameter may be related to an underexposed or overexposed tolerance position, or even a generalized maximum or minimum that is permissible under tolerances; it instead discloses a set of process parameters whose values, when varied, are found to be correlated with the dependently varying values of certain shape parameters in the printed patterns. Intensity parameters and their resulting exposures, over or under, are highly relevant when printing or patterning a wafer. Mieher measures rather than patterns, so there is no "permitted" intensity parameter; the exposure is already completed in the structures that Mieher measures with the scatterometry detailed above. Knowing this measured "second set of shape parameters" and the correlation from different first sets of shape and process parameters enables Mieher to empirically determine the "second set of process parameters" of para. [0008] that was used to print the shapes represented by the second set of shape parameters. Mieher's mention of exposure and focus being important process parameters is in relation to showing their strong correlation to shape parameters of shapes manufactured from that process. Mieher is not seen to disclose intensity parameters relevant to over/under exposure; whatever value an exposure process parameter takes on is either determined empirically from shape parameters, or known from data used to make the correlation among the first sets of shape/process parameters. This distinction flows again from the different predominant teachings of the invention versus Mieher: the former directed more toward fabrication and the latter toward measuring then determining an unknown parameter set for calibration. Claim 8 recites similarly for a system.

Fourth Distinction: determining optimum source intensities using a linear program.

Claim 1 recites: **"determining optimum source intensities using a linear program"**. The Office Action cites against this para. [0090] of Mieher, which discloses: "In most cases, the corrections are fed into a program or computer that analyzes and decides what actual correction

to make." The written description details a non-linear versus a linear program at pages 37 line 1 (equation [2] described as non-linear) through page 48, line 2. As disclosed at page 44 lines 2-3, setting $K_{Max}$ to a fixed value makes Eq. [6] a pure linear programming problem. Pages 44-48 describe how Eq. [6] is related to non-linear Eq. [2]. Mieher is not seen to disclose that its software or computer use a linear program to determine optimum source intensity or any other correction. Claims 1 and 8 are amended to more clearly relate the optimum source intensities to the previously recited incident beams. This is different from a simple dose adjustment as in Mieher. Mieher is seen neither to use a plurality of incident beams for defining shapes, nor to determine optimum source intensities for a plurality of beams from the source using a linear program. Note the application title recites in part "Adjustment of the Source Distribution" rather than merely adjusting exposure or intensity.

Additionally, it is noted that the term "linear program" in claim 1 need not imply a computer software program, though a computer program may implement it. The term linear program may refer to a type of mathematical problem. As one non-limiting example, the National Institute of Standards and Technology NIST defines "linear program" as "A problem expressible in the following form. Given an n × m real matrix A, m-vector b and n-vector c, determine $\min_x\{c\cdot x \mid Ax \geq b \text{ and } x \geq 0\}$ where x ranges over all n-vectors and the inequalities are interpreted component-wise, i.e., $x \geq 0$ means that the entries of x are nonnegative." See the NIST online Dictionary of Algorithms and Data Structures at www.nist.gov/dads. Mieher clearly discloses no such linear program. Claim 8 recites similarly as means for determining using a linear program.

Respecting the constraints relevant to the linear program recited in claim 11, the distinction between constraint and parameter detailed above in the Third Distinction are repeated.

Fifth Distinction: maximize an integrated range.

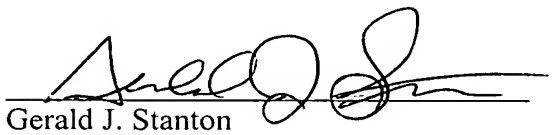
Claim 1 recites: **"maximize an integrated range of at least one of dose variations and focal variations without causing printed shapes to depart from the allowed range."** The Office Action cites to para. [0034], which discloses again the correlation between shape and process parameters, specifically more than one shape parameter may be a function of exposure dose and focus. As there is no "allowed range" defined when Mieher determines the correlation later used

to empirically determine a second set of process parameters, this claim element is seen as beyond the Mieher disclosure. Further, there is not seen in Mieher an "integrated range of dose and/or focal variations" for which source intensities are determined. In claim 1, that integrated range relates to the plurality of beams that Mieher does not appear to disclose. Claim 8 recites similarly.

Given the extent of the above arguments, the Applicant foregoes further arguments as to dependent claims. This is not to be implied as agreeing or acquiescing with the Examiner's rejection of them or reasoning behind those rejections.

The independent claims, and by implication the dependent claims, are seen to be in condition for allowance. The Applicant respectfully requests that the Examiner review the cited art and rejections in light of the above remarks, and pass each of claims 1-2, 8-10, and 22-23 to issue. The undersigned representative welcomes the opportunity to resolve any matters that may remain, formal or otherwise, via teleconference at the Examiner's discretion.

Respectfully submitted:



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